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ABSTRACT

Several intermediate performance objectives and corresponding criterion measures are listed for each of eight terminal objectives for a high school intermediate machine shop course. The materials were developed for a 36-week course (3 hours daily) designed to enable students to become familiar with the operation of machine shop equipment, to become familiar with those basic skills and trade technology required by the machinist in doing machinists work, and to diagnose and solve technical problems as expected of a competent journeyman machinist. Titles of the eight performance objectives sections are Shaper, Horizontal Milling Machine, Vertical Milling Machine, Maintenance, Forge, Heat Treating, Welding (oxy-acet., arc), and Shop Management. (This manual and 54 others were developed for various secondary level vocational courses using the System Approach for Education (SAFE) guidelines.) (HD)

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CAREER EDUCATION

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CE 010 972

Intermediate Course

DUVAL COUNTY SCHOOL BOARD

machine shop

PERFORMANCE OBJECTIVES

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July, 1972

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MACHINE SHOP WORK - INTERMEDIATE

ACCREDITION NO. 9555

LENGTH OF COURSE: 36 WEEKS

TIME BLOCK: 3 HOURS DAILY

COURSE DESCRIPTION

Intermediate course students will qualify in the following:

A - Precision Tools

B - Manual Operations

C - Equipment

D - Mathematics

E - Milling Machine Operations

F - Broaching

G - Metallurgy

T.P.O.'S MACHINE SHOP

INTERMEDIATE

9555

14.0 Shaper

15.0 Horizontal Milling Machine

16.0 Vertical Milling Machine

17.0 Maintenance

18.0 Forge

19.0 Heat Treating

20.0 Welding (oxy-acet., arc)

21.0 Shop Management

ACCREDITATION NUMBER 9555

COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 14.0 SHAPER

Upon completion of a series of lectures and demonstrations 80% of the student must earn 70% proficiency in naming the parts of the shaper and their functions.

o.	Intermediate Performance Objectives	No.	Criterion Measures
		14.0	Test attached
4.1	Student will demonstrate 70% proficiency in squaring a rectangular block.	14.1	Given a shaper and a piece of material student will demonstrate 70% proficiency in squaring a rectangular block.
4.2	Student will demonstrate 70% proficiency in shaping a tongue and groove.	14.2	Given a shaper and a piece of metal, student will demonstrate 70% proficiency in shaping a tongue and groove.
4.3	Student will demonstrate 70% proficiency in shaping slots and keyways.	14.3	Given a shaper and a piece of metal, student will demonstrate 70% proficiency in shaping dovetail.

Terminal Performance Objective 14.0
Interim Performance Objective 14.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Ti Requ
14.1.1	Identify the tools needed in squaring a rectangular block.	14.1.1	List the tools needed in squaring a rectangular block	14.1.1	Lecture, Text, Demonstration	
14.1.2	Identify the safety precautions to be followed before starting the ram.	14.1.2	List safety precautions to be followed before starting the ram.	14.1.2	Lecture, Text, Demonstration	
14.1.3	Explain the functions of the shaper tool head.	14.1.3	Identify the functions of the shaper tool head.	14.1.3	Lecture, Text	
14.1.4	Explain the function of the table	14.1.4	Explain the functions of the table.	14.1.4	Lecture, Text	
14.1.5	Explain the length of the stroke, speed of stroke.	14.1.5	Outline the association between length of the stroke and speed of the stroke.	14.1.5	Demonstration	
14.2.1	Identify the cutting tools needed in shaping a tongue and groove.	14.2.1	List the cutting tools needed in shaping a tongue and groove.	1 .2.1	Lecture, Text	
14.3.1	Name the type of cutting tools needed for shaping keyways.	14.3.1	List the type of cutting tool needed for shaping keyways.	14.3.1	Lecture, Text	
14.4.1	Identify procedures to be followed when cutting a dovetail.	14.4.1	List procedures to be followed when cutting a dovetail.	14.4.1	Lecture, Text, Demonstration	
14.4.2	Identify holddowns used in all shaper work.	14.4.2	List hold down used in all shaper work.	14.4.2	Lecture, Text, Demonstration	

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COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 15.0

HORIZONTAL MILLING MACHINE

After a series of lectures and demonstrations on the horizontal milling machine students will be able to identify 80% of the parts and their functions, and perform 70% of the operations machine is capable of doing.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		15.0	Test attached.
15.1	Student will demonstrate 70% proficiency in squaring the sides of a rectangular block.	15.1	Given a horizontal milling machine and a rectangular block, students will demonstrate 70% proficiency in squaring the sides.
15.2	Students will demonstrate 70% proficiency in squaring the ends of a work-piece.	15.2	Given a horizontal milling machine and a rectangular block, students will demonstrate 70% proficiency in squaring the ends.
15.3	Students will demonstrate 70% proficiency in cutting a keyway of similar groove.	15.3	Given a horizontal milling machine and a 1" round shaft, students will demonstrate 70% proficiency in cutting a keyway.

Terminal Performance Objective 15.0
Interim Performance Objective 15.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection
15.1.1	Students will identify the tools needed to square the sides of a rectangular block. a) What will be the speed of arbon? b) What will be the feed of the table?	15.1.1	Students will list the tools needed to square the sides of a rectangular block. a) Students will demonstrate the proper speed of the arbon. b) Students will demonstrate the feed of the table.	15.1.1	Lectures, demonstrations, text.
15.1.2	Students will identify the tools needed to square the ends of a rectangular block. a) What will be the speed of the arbon? b) What will be the feed of the table?	15.1.2	Students will list the tools needed to square the ends of a rectangular block. a) Students will demonstrate the speed of the arbon. b) What will be the feed of the table?	15.1.2	Lectures, Text, demonstrations
15.1.3	Students will identify the tools needed to cut a keyway. a) What will the speed of the arbor be? b) What will be the feed of the table.	15.1.3	Students will list the tools needed to cut a keyway or similar groove. a) Students will demonstrate the speed of the arbon. b) Students will demonstrate the feed of the table.	15.1.3	Lectures, demonstration, Text.

HORIZONTAL MILLING MACHINE

1. Name the two most versatile machines in the metal working industry.
2. Explain the use of the T slots in the milling machine table.
3. What type of work requires the use of shims and wedges?
4. Name five types of vises used in milling machine practice and explain their differences.
5. Give the uses of milling machine fixtures.
6. What method is used to locate the job in a fixture?
7. Why is it necessary to clean the fixtures before each loading?
8. Why is the milling machine vise used more often than any other milling attachments?
9. Give three factors contributing to the misalignment of the milling machine vise on the table.
10. Explain the method of aligning the vise jaw parallel with the cut using the dial indicator.
11. Explain the method of squaring the vise jaw at right angles to the cut using the dial indicator.
12. To what degree of accuracy can the milling machine vise be aligned?
13. State two other methods of aligning the vise.
14. Explain how the vise can be used as a fixture on jobs of irregular shapes.
15. Give three hazards endangering the safety of the operator.
16. How should the machinist care for his tools when making milling machines setups?
17. Explain the cutting action of a milling machine cutter.

18. When would it be most practical to use a cemented carbide cutter?
19. State reasons for using cutting fluids.
20. What is the correct method of securing an end mill in the machine spindle?
21. Explain what is meant by speed and feed?
22. When is it practical to use the positive stop?
23. Name the three operations other than milling for which the milling machine can be used.
24. What type of milling cutter is used to mill keyways.

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COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 16.0

VERTICAL MILLING MACHINE

The learner will identify 80% of the parts of the vertical milling machine, name their functions and will perform given tasks on this machine at 70% efficiency.

No.	Intermediate Performance Objectives	No.	Criterion Measures
16.1	Student will demonstrate 70% proficiency in the use of a Woodruff Key Cutter.	16.1	Given a vertical milling machine and round piece of stock, student will demonstrate 70% proficiency in cutting a half moon keyway with a $\frac{1}{4}$" x 1" Woodruff Key Cutter.
16.2	Student will demonstrate 70% proficiency in cutting a with the end mill.	16.2	Given a vertical milling machine and a piece of round stock 12" long, student will demonstrate 70% proficiency in cutting a keyway the length of piece using a 3/8" end mill.
16.3	Student will demonstrate 70% proficiency in cutting a keyway using the slotting attachment.	16.3	Student, given a vertical milling machine and a flat block of steel with one inch hole in it, will demonstrate 70% efficiency in cutting an inside keyway using the slotting attachment.

VERTICAL MILLING MACHINE TEST

1. What is a milling machine?
2. How does it differ from a lathe?
3. Differentiate between factory production milling and tool room milling.
4. Name 5 important things a milling machine operator must know in order to operate the machine intelligently.
5. Name 2 types of milling machines.
6. How do they differ?
7. Name and explain 3 different table feeds.
8. Why should the spindle hole be clean?
9. Why should it be wiped dry?
10. What is the function of the trip dogs?
11. What is the function of the table stops?
12. What is the normal direction of the spindle? Why?
13. How is the reverse direction of a spindle obtained?
14. Is there a power table feed?
15. Is there a power cross feed?
16. Give the name and function of attachments for vertical mill.
17. What kind of job can be done on the vertical mill?
18. Can the same job be done on the horizontal mill?
19. Is the feed independent of the spindle speed?

20. How many spindle speeds are on this machine?

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COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 17.0

MAINTENANCE

Upon completion of a series of lectures and demonstrations on the maintenance of machines the students will answer 70% of the written test. Students will demonstrate their ability in performance of the maintenance of the machines with 80% accuracy.

No.	Intermediate Performance Objectives	No.	Criterion Measures
17.1	Student will perform maintenance on machines with 90% efficiency before starting machine for the tasks at hand.	17.1	If assigned to machine, student will check machine for safety. a) Is chuck securely fastened to spindle? b) Are electrical connections properly insulated? c) Are the vises and arbors locked in position? d) Is there an excess of oil and chips on the floor?
		17.2	Student will oil and grease machine as per lubrication charts.
		17.3	Student will make certain all tools and accessaries neccessary for the safe operation of machine are hand and in good working order.

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COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 18.0 FORGE

Upon completing a series of lectures and demonstrations on the forge, 80% of the students will answer 70% of the questions on a written test.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		18.0	Test attached
18.1	Student will demonstrate 70% accuracy on 4 forging operations	18.1	Given a piece of metal, student will demonstrate the 4 following forge operations: 1) Drawing or Drawing out 2) Spreading 3) Upsetting 4) Welding

FORGE

1. What do you understand by steel flowing under the hammer?
2. Which is hotter, cherry or yellow? About how many degrees?
3. Explain how work is drawn to a square cross section.
4. Explain how work is drawn to a round cross section.
5. Explain the method of drawing equal opposite shoulders on the end of a bar.
6. What type of tongs are used to hold a short piece in upsetting.
7. What is meant by the mean circumference of a forged ring?
8. Why does the smith need to know the approximate mean circumference in forging an eye?
9. Explain how the smith uses a chalk mark on the anvil to lay off on the work the length to be bent.
10. After the work is bent a right angle, how do you proceed to forge the eye?
11. What is the operation of scarfing?
12. What is the purpose of a flux in welding?
13. Why must the work be very hot in order to weld?
14. Why does the smith work so fast in making a weld?

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COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 19.0 HEAT TREATING

After a series of lectures and demonstrations on heat treating(annealing quenching, hardening, tempering, normalizing, case hardening, normalizing) 80% of the students will demonstrate their ability to perform heat treating poerations with 70% accuracy.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		19.0	Test attached
19.1	Students will demonstrate 70% proficiency in the following heat treating operations. a) hardening b) annealing c) quenching d) tempering e) normalizing	19.1	Given a hardening furnace and a piece of metal students will demonstrate 70% proficiency in the following operations. a) hardening b) annealing c) quenching d) tempering e) normalizing

ACCREDITATION NUMBER 9555

COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 20.0 WELDING

No.	Intermediate Performance Objectives	No.	Criterion Measures
20.		20.0	1) What is the 3 advantages of the oxy-acet. welder? 2) What is the 3 advantages of the electric welder? 3) By which welding process is the most desirable cutting done? Why? 4) How do you set a welding flame?
20.1	Given a oxy-acet. welder 80% of the students will safely operate the welder to a 70% efficiency as determined by welding standards.	20.1	Students will set the welding flame and perform the following welds: 1) Bead without rod 2) Bead with rod 3) Butt weld 4) Cormer weld 5) Kap weld 6) Tweld weld 7) Pipe weld
20.2	Given a arc. welder 80% of the students will operate the machine safely to 70% efficiency as determined by a welding standard.	20.2	Save as above except with the arc. welder.

WELDING TEST

1. What are the 3 advantages of an oxy-acet. welder?
2. What are the 3 advantages of an arc. welder?
3. By which welding process can the most desirable cutting be done? Why?
4. How do you set a welding flame?
5. What are the 3 flames?
6. Explain the use of each flame.
7. What is the difference between a arc welding lense and a oxy-acet. welding lense?
8. What is meant by tack?
9. What is meant by fusion?
10. What is meant by penetration?
11. What is the heat range on the 3/32" - 5/32" arc rod?
12. What light rays cause eye damage from arc welding?
13. Name the equipment needed for arc welding.
14. Name the equipment needed for oxy-acet. welding.
15. Name the 4 bases welds.
16. How do you reduce the bottle pressure to working pressure?
17. What are the desired working pressures? oxy? acet?
18. What are rod coating or flux?
19. What is slag?
20. What is meant by pass?

WELDING TEST CON'T.

21. What will arc ray do to your skin?

22. Who is responsible to see that others not burned? How can he protect others?

23. How do you lubricate oxy-acet welding equipment?

24. What are the parts of a weld?

25. What is the first aid for a burn?

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COURSE TITLE: MACHINE SHOP WORK - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 21.0

SHOP MANAGEMENT

The student will with 80% proficiency draw an organization chart, enter an initial stock and tool order and set up typical inventory cards for a machine shop.

No.	Intermediate Performance Objectives	No.	Criterion Measures
.1	The student will with 80% proficiency draw an organization chart and layout of machinary for a fully equipped machine shop.	21.1	Draw an organization chart and lay out of a machine shop.
.2	The student will with 80% proficiency make up an initial accessory machine tools and stock for a machine shop.	21.2	Make up an initial tool parts order for a fully equipped machine shop.
.3	The student will with 80% proficiency set up a perpetual inventory card system for a machine shop.	21.3	Set up a perpetual inventory card system for restocking a machine shop.